Salmonella spp.
and *Listeria monocytogenes*
in Raw Liquid Egg Products
in Federally Inspected Processing Establishments

L. Victor Cook
Microbiology Division
Office of Public Health Science
Food Safety and Inspection Service
U. S. Department of Agriculture

Rationale & Objective

Rationale:

• current time/temperature specifications for liquid egg pasteurization
  - appear to be effective.
  - are based on studies from the 1960s.

• new microbiological data fills a critical gap necessary for meeting risk assessment and risk management needs

e.g. *Salmonella* lethality performance standard for pasteurization

Objective:

• determine prevalence and level of *L. monocytogenes* and *Salmonella* spp. in raw liquid egg products in the United States

Baseline Sampling Design

October 2001 – March 2003

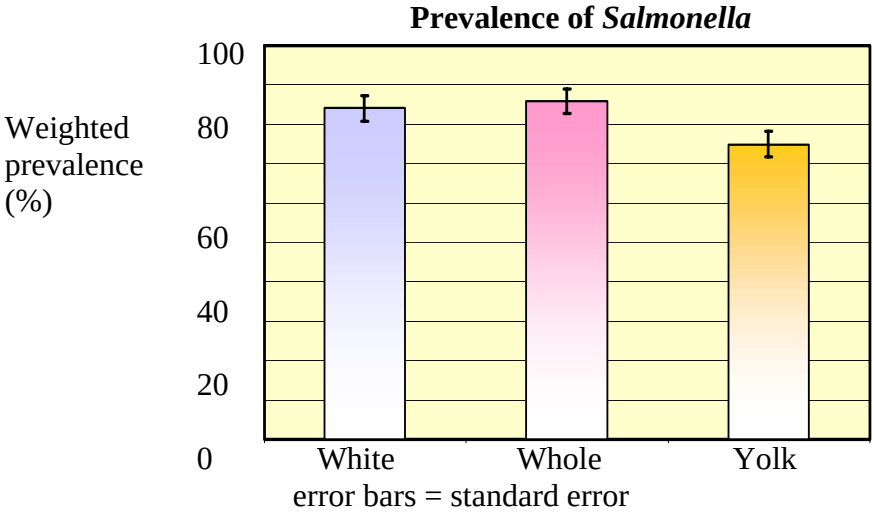
raw product	sample size	# of estab.
liquid egg whites	340	48
liquid egg whites	375	64
liquid egg olks	19	42

- samples collected prior to processing
- production volume during sampling period used for weighted calculations

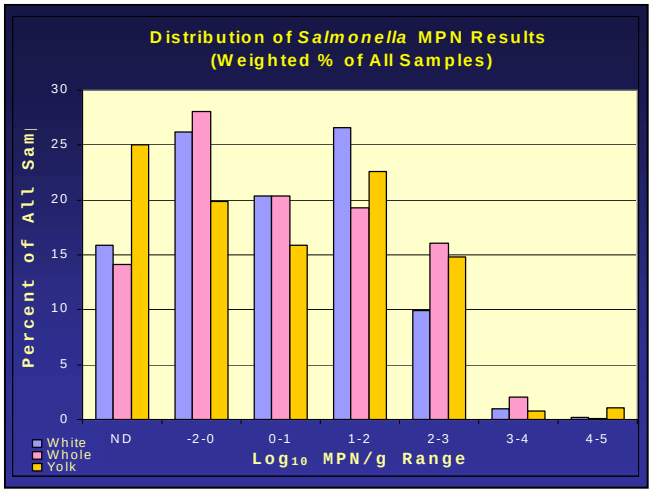
Analytical Methods

- *Salmonella* spp. and *Listeria monocytogenes*
  - USDA FSIS methods
  - Quantitative: 3-tube MPN
  - 10 ml test portion for each tube of first dilution
  - Lower limit of detection: 0.03 MPN/ml

FSIS microbiological methods
are available online at:
http://www.fsis.usda.gov



Whole eggs = highest weighted prevalence = 85.9% (unweighted 80%)
White = 84.1% (73.5%)
Yolk = lowest prevalence = 74.9% (67.4%)



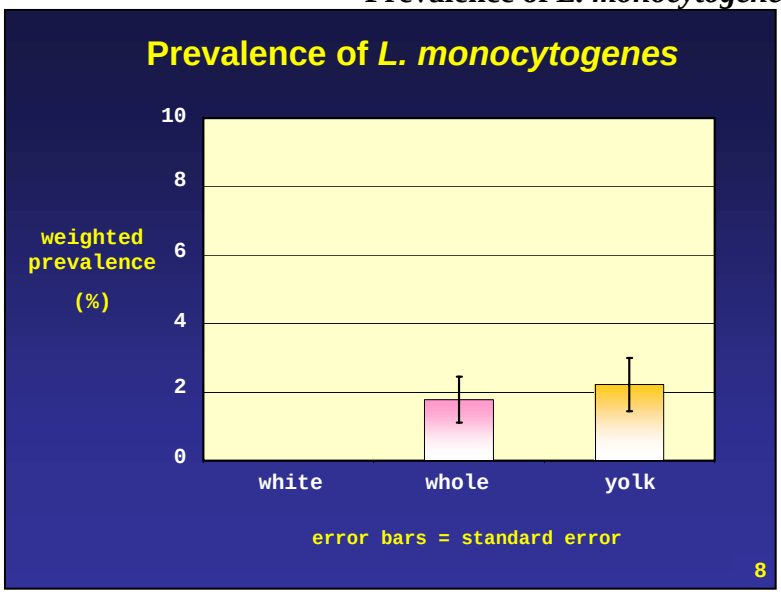
This graph includes negative samples = ND (LOD = 0.03 MPN/ml)
Most significant decrease is from log 2-3 to 3-4.
1% of yolk samples and less than 0.2% of white and whole egg contained 4-5 logs of *Salmonella*.

Predominant *Salmonella* Serotypes

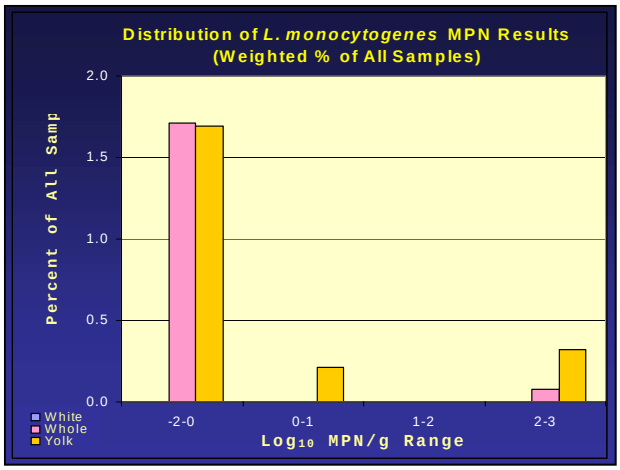
Percent of positive samples				
Serotype	white	whole	yolk	all
Heidelberg	51.2	50.3	44.2	48.9
Enteritidis	44.0	32.0	48.4	40.5
All others	19.2	35.7	21.9	26.4

These represent percentages of POSITIVE samples that were found to contain these serotypes.
All MPN tubes within the readable 3-dilution frame were confirmed. As a result, some samples had two or more serotypes. For this reason, the sums for percentages in each column exceed 100%.
One yolk sample with a count of 240 cfu/ml had 5 different serotypes.
Heidelberg was found most often in egg white and whole egg, and Enteritidis was found somewhat more often in egg yolk.
A variety of other serotypes were encountered at much lower incidence including Kentucky, Braenderup and Typhimurium.

Prevalence of *L. monocytogenes*



No Lm was detected in the egg white samples.
Weighted prevalence was about 2% for whole egg and egg yolk.



This chart represents percent of all samples but does not include a graph of the negative samples.

The Lm that was detected in yolk and whole egg was typically present at levels less than 1 MPN/g but a few samples of each had 100-1000 MPN/g.

Conclusions

- Most liquid egg products sampled prior to pasteurization were *Salmonella*-positive in all product types.
- About 1% of yolk samples and less than 0.2% of white and whole egg samples contained 4-5 $\log_{10}$ of *Salmonella*.
- *S.* Heidelberg and *S.* Enteritidis were clearly predominant serotypes.
- *L. monocytogenes* was found in only a small percentage (~ 2%) of whole egg and egg yolk samples.

The Raw Liquid Egg Baseline Team

- OPHS, Microbiology Division, Washington, D. C.
  - Dr. Walt Hill
  - Mr. Victor Cook, Ms. Priscilla Levine, Ms. Nisha Oatman, Dr. Celine Nadon, and Dr. Parmesh Saini
- OPHS, Risk Assessment Division, Washington D.C.
  - Dr. Carl Schroeder and Dr. Wayne Schlosser
- OPPED, Washington, D.C.
  - Dr. Barat Patel and Mr. Harry Marks
- OPHS, Microbiology Division, MOSPL, Athens, GA
  - Dr. Doug Abbott and Dr. William Cray
- OPHS, Technical Service Laboratories
  - Dr. Patrick McCaskey, Athens, GA
  - Mr. Larry Dillard and technical staff, Athens, GA
  - Mr. Mark Pratt and technical staff, St. Louis, MO

  - Mr. John Rivera and technical staff, Alameda, CA
- TSC, Omaha, NE
  - Ms. Suzanne Hasiak